Mass Stranding of Beaked Whales in the Galapagos Islands, April 2000

by Roger L. Gentry, October 30, 2002

Background:

This stranding of beaked whales in the Galapagos Islands in 2000 was first reported to NMFS on October 24, 2002 by Dr. Bruce Mate of Oregon State University. Dr. Mate, Mr. Daniel Palacios, and Dr. Jorge Urban of the Autonomous University of Baja California Sur were discussing the stranding of two beaked whales (*Ziphius cavirostris*) in the Gulf of California on September 24, 2002. When it was mentioned that the NSF-supported *R/V Maurice Ewing* had been conducting a seismic airgun survey in the area at the time, Mr. Palacios recalled that the same vessel had been conducting a seismic survey off the Galapagos Islands in April 2000 when three *Z. cavirostris* stranded on Santa Cruz Island. He had not previously mentioned this coincidence to anyone, he did not notify the *R.V. Maurice Ewing* at the time, and the stranding was never reported publically. The three decided to report this event to NMFS in view of a legal action then pending against NSF for continuing the *R/V Maurice Ewing's* survey of the Gulf of California. They reported it to Dr. Roger Gentry at the NMFS Office of Protected Resources. The facts below were contributed by Mr. Palacios, Dr. John Sinton (PI on the Galapagos cruise), NSF, Lamont-Doherty Earth Observatory (operators of the *R/V Maurice Ewing*), and Drs. Godfrey Merlen and Sandi Salazar of the Charles Darwin Research Station in the Galapagos.

Synopsis of the Galapagos stranding:

This report of the stranding was written by Dr. Salazar, and was translated into English on October 25, 2002 by Daniel Palacios.

Day: 11 April (2000)

Time: 06:00 am (approx.)
Island: Santa Cruz
Site: Tortuga Bay (to the north of Playa Brava)
Species: *Ziphius cavirostris*
Number of individuals: 3 adults
2 individuals were stranded on rocks and they were rescued and taken to deeper waters. The only individual that stranded on sand died after at least two hours of the sighting.

Dead individual:

Age/class: adult
Length: 5.10 m
Primary color: gray
Secondary color: white
Markings on the sides: white circles
External lesions: absent

Possible causes of death: Asphyxia (there was presence of sand in the blowhole)
Stomach content: several beaks of cephalopods.

The stranding site is shown in Figure 1. The dotted line shows the route whales would have had to take to reach the site by remaining in deep water (which beaked whales prefer). There is no evidence the whales actually followed this route. The whales that were pushed off were not sighted again.

Necropsy Report:

A necropsy was performed on the dead whale by Godfrey Merlen, Sandi Salazar and assistants. They did not write a necropsy report at the time. On request, Dr. Merlen wrote an informal description of their findings, based on his field notes, on October 29, 2002. The pertinent part of this report is as follows:

> "As far as the stranding goes it seems that there was at least one whale that did not strand and was seen at sea off the beach. Two we got off the beach and they were not reported again on the shore anywhere. I guess they could have died at sea? The third died in the surf as there were not enough people to attend to them all. Probably of overheating and pressure as the lungs were empty of water. I cut this animal up as a specimen. None of the three was bleeding from the head. I did not notice any damage around the ears or any internal bleeding. The ear bones were complete and in place. The lower jaws complete. Of course I do not claim to be a specialist at looking for this kind of damage but I have dissected a few heads and found this one normal. The stomach, as reported, contained squid beaks but no squid. As I have no idea how long it takes to digest a squid I cannot say when this animal last fed. There were no other sign of damage, externally or internally, except for the round or crescent shaped scars on the body."

Dr. Merlen stated that they did not open the skull during the necropsy.

Activities of the R/V *Maurice Ewing*:

Mr. Palacios learned that the *R/V Maurice Ewing* was operating an airgun array in the vicinity on April 15 while he was conducting a marine mammal survey. The Ewing informed him by VHF radio that they had gear in the water. On his return to port, Dr. Merlen informed him about the beaked whale stranding on April 11.

Full information about the seismic array used appears at:
http://obslab.whoi.edu/ew0004/seismic_refrac_experiment.html
Information about the ship's track line appears at:
http://obslab.whoi.edu/ew0004/navigation/navigation.lhtml

As a summary, Figure 2 shows the track line of the R/V *Maurice Ewing* from April 6 to April 11 (provided by the Lamont-Doherty Earth Observatory). It shows the ship was moving generally from west to east on these days. On April 11 it was closer to the islands than on any previous day of the cruise, and was then 270 nmi from the northwest corner of Santa Cruz Island where the stranding occurred.

On April 6 and 7 the ship was towing a 20 airgun array; from April 9 to 11 it was towing a 10 gun array. The source levels (reported separately by NSF) were 255 dB (summed peak-to-peak) for the 10 gun array, and 262 dB (summed peak-to-peak) for the 20 gun array.

Discussion:

The necropsy report is inconclusive. It did not find trauma of the type that is typically associated with acoustic sources (hemorrhage around the eyes or ear bones, see Interim Report of the Bahamas Beaked Whale Stranding; 2001). On the other hand, it did not examine the brain, which sometimes shows hemorrhages when animals have been exposed to intense sound fields. Therefore, the necropsy report can neither confirm nor deny acoustic injury.

It is not feasible that the sound field from the *R/V Maurice Ewing* affected animals that were resident near the stranding site. Since spreading loss causes the intensity of a sound to drop by a factor of 4 with each doubling of distance from the source, the level at more than 200 nmi would have been well below the levels known to cause tissue damage. There is no mechanism presently known by which beaked whales could have been affected at such a distance.

It is possible that these beaked whales were exposed close to the ship and swam to the stranding site. Field measurements show that healthy marine mammals can swim at 3 meters per second and thereby could cover 270 nmi (500 km) in 48 hours. Whether animals that have been disoriented or injured by an airgun array could have done so is not known.

Conclusions:

It is not possible to conclude whether the *R/V Maurice Ewing* was involved in this stranding. Cause and effect can only be determined from necropsy results which, in this case, were inconclusive. Correlation does not substitute for cause and effect, but it can indicate whether certain causes are feasible. In this case, the stranding and the seismic survey were correlated in time, but not in space. There is no obvious mechanism that bridges the distance between this source and the stranding site. Therefore, the cause remains indeterminate.